

No.

200100098



THE UNITED STATES OF AMERICA

TO ALL TO WHOM THESE PRESENTS SHALL COME:

NASH Research Foundation

Whereas, THERE HAS BEEN PRESENTED TO THE

Secretary of Agriculture

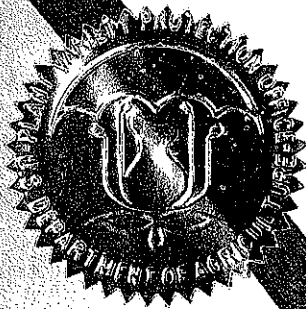
AN APPLICATION REQUESTING A CERTIFICATE OF PROTECTION FOR AN ALLEGED DISTINCT VARIETY OF SEXUALLY REPRODUCED, OR TUBER PROPAGATED PLANT, THE NAME AND DESCRIPTION OF WHICH ARE CONTAINED IN THE APPLICATION AND EXHIBITS, A COPY OF WHICH IS HEREUNTO ANNEXED AND MADE A PART HEREOF, AND THE VARIOUS REQUIREMENTS OF LAW IN SUCH CASES MADE AND PROVIDED HAVE BEEN COMPLIED WITH, AND THE TITLE THERETO IS, FROM THE RECORDS OF THE PLANT VARIETY PROTECTION OFFICE, IN THE APPLICANT(S) INDICATED IN THE SAID COPY, AND WHEREAS, UPON DUE EXAMINATION MADE, THE SAID APPLICANT(S) IS (ARE) ADJUDGED TO BE ENTITLED TO A CERTIFICATE OF PLANT VARIETY PROTECTION UNDER THE LAW.

NOW, THEREFORE, THIS CERTIFICATE OF PLANT VARIETY PROTECTION IS TO GRANT UNTO THE SAID APPLICANT(S) AND THE SUCCESSORS, HEIRS OR ASSIGNS OF THE SAID APPLICANT(S) FOR THE TERM OF TWENTY YEARS FROM THE DATE OF THIS GRANT, SUBJECT TO THE PAYMENT OF THE REQUIRED FEES AND PERIODIC REPLENISHMENT OF VIABLE BASIC SEED OF THE VARIETY IN A PUBLIC REPOSITORY AS PROVIDED BY LAW, THE RIGHT TO EXCLUDE OTHERS FROM SELLING THE VARIETY, OR OFFERING IT FOR SALE, OR REPRODUCING IT, OR IMPORTING IT, OR EXPORTING IT, OR CONDITIONING IT FOR PROPAGATION, OR STOCKING IT FOR ANY OF THE ABOVE PURPOSE, OR USING IT IN PRODUCING A HYBRID OR DIFFERENT VARIETY THEREFROM, TO THE EXTENT PROVIDED BY THE PLANT VARIETY PROTECTION ACT. IN THE UNITED STATES SEED OF THIS VARIETY (1) SHALL BE SOLD BY VARIETY NAME ONLY AS A CERTIFIED SEED AND (2) SHALL CONFORM TO THE NUMBER OF GENERATIONS SPECIFIED BY THE OWNER OF THE SEED. (STAT. 1542, AS AMENDED, 7 U.S.C. 2321 ET SEQ.)

BARLEY

'Drummond'

In Testimony Whereof, I have hereunto set my hand and caused the seal of the Plant Variety Protection Office to be affixed at the City of Washington, D.C. this second day of April, in the year two thousand two.



Attest:

Paul M. Zerk

Commissioner
Plant Variety Protection Office
Agricultural Marketing Service

W. H. Sherman

Secretary of Agriculture

U.S. DEPARTMENT OF AGRICULTURE
AGRICULTURAL MARKETING SERVICE
SCIENCE AND TECHNOLOGY - PLANT VARIETY PROTECTION OFFICEAPPLICATION FOR PLANT VARIETY PROTECTION CERTIFICATE
(Instructions and information collection burden statement on reverse)

The following statements are made in accordance with the Privacy Act of 1974 (5 U.S.C. 552a) and the Paperwork Reduction Act (PRA) of 1995.

Application is required in order to determine if a plant variety protection certificate is to be issued (7 U.S.C. 2421). Information is held confidential until certificate is issued (7 U.S.C. 2426).

1. NAME OF OWNER NDSU Research Foundation		2. TEMPORARY DESIGNATION OR EXPERIMENTAL NAME ND15477	3. VARIETY NAME Drummond
4. ADDRESS (Street and No., or R.F.D. No., City, State, and ZIP Code, and Country) c/o Executive Director NDSU Research Foundation P.O. Box 5014 Fargo, ND 58105-5014		5. TELEPHONE (include area code) (701) 231-8931	FOR OFFICIAL USE ONLY FVRO NUMBER 20010009
		6. FAX (include area code) (701) 231-1013	FILING DATE 2/6/2001
7. IF THE OWNER NAMED IS NOT A "PERSON", GIVE FORM OF ORGANIZATION (corporation, partnership, association, etc.) Corporation	8. IF INCORPORATED, GIVE STATE OF INCORPORATION ND	9. DATE OF INCORPORATION May 1989	
10. NAME AND ADDRESS OF OWNER REPRESENTATIVE(S) TO SERVE IN THIS APPLICATION. (First person listed will receive all papers)			FILING AND EXAMINATION FEES: \$ 2705.00 DATE 2/6/01 CERTIFICATION FEE: \$ 320.00 DATE 1/30/02
Richard D. Horsley Department of Plant Sciences North Dakota State Univrsity P.O. Box 5051 Fargo, ND 58105-5051		Dale Zetocha Executive Director NDSU Research Foundation P.O. Box 5014 Fargo, ND 58105-5014	
11. TELEPHONE (Include area code) (701) 231-8142	12. FAX (Include area code) (701) 231-8474	13. E-MAIL richard_horsley@ndsu.nodak.edu	14. CROP KIND (Common Name) barley

18. CHECK APPROPRIATE BOX FOR EACH ATTACHMENT SUBMITTED (Follow instructions on reverse)		19. DOES THE OWNER SPECIFY THAT SEED OF THIS VARIETY BE SOLD AS A CLASS OF CERTIFIED SEED? See Section 83(a) of the Plant Variety Protection Act	
a. <input checked="" type="checkbox"/> Exhibit A. Origin and Breeding History of the Variety b. <input checked="" type="checkbox"/> Exhibit B. Statement of Distinctness c. <input checked="" type="checkbox"/> Exhibit C. Objective Description of Variety d. <input checked="" type="checkbox"/> Exhibit D. Additional Description of the Variety (Optional) NO EXD Submitted 2/6/2001 mail e. <input checked="" type="checkbox"/> Exhibit E. Statement of the Basis of the Owner's Ownership f. <input checked="" type="checkbox"/> Voucher Sample (2,500 viable untreated seeds or, for tuber propagated varieties, verification that tissue culture will be deposited and maintained in an approved public repository) g. <input checked="" type="checkbox"/> Filing and Examination Fee (\$2,705), made payable to "Treasurer of the United States" (Mail to the Plant Variety Protection Office)		<input checked="" type="checkbox"/> YES (If "yes", answer items 20 and 21 below) <input type="checkbox"/> NO (If "no," go to item 22) 20. DOES THE OWNER SPECIFY THAT SEED OF THIS VARIETY BE LIMITED AS TO NUMBER OF CLASSES? <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO IF YES, WHICH CLASSES? <input checked="" type="checkbox"/> FOUNDATION <input checked="" type="checkbox"/> REGISTERED <input checked="" type="checkbox"/> CERTIFIED 21. DOES THE OWNER SPECIFY THAT THE CLASSES BE LIMITED AS TO NUMBER OF GENERATIONS? <input type="checkbox"/> YES <input checked="" type="checkbox"/> NO IF YES, SPECIFY THE NUMBER 1, 2, 3, etc. <input type="checkbox"/> FOUNDATION <input type="checkbox"/> REGISTERED <input type="checkbox"/> CERTIFIED (If additional explanation is necessary, please use the space indicated on the reverse.)	
22. HAS THE VARIETY (INCLUDING ANY HARVESTED MATERIAL) OR A HYBRID PRODUCED FROM THIS VARIETY BEEN SOLD, DISPOSED OF, TRANSFERRED, OR USED IN THE U. S. OR OTHER COUNTRIES? <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO IF YES, YOU MUST PROVIDE THE DATE OF FIRST SALE, DISPOSITION, TRANSFER, OR USE FOR EACH COUNTRY AND THE CIRCUMSTANCES. (Please use space indicated on reverse.)		23. IS THE VARIETY OR ANY COMPONENT OF THE VARIETY PROTECTED BY INTELLECTUAL PROPERTY RIGHT (PLANT BREEDER'S RIGHT OR PATENT)? <input type="checkbox"/> YES <input checked="" type="checkbox"/> NO IF YES, GIVE COUNTRY, DATE OF FILING OR ISSUANCE AND ASSIGNED REFERENCE NUMBER. (Please use space indicated on reverse.)	

24. The owners declare that a viable sample of basic seed of the variety will be furnished with application and will be replenished upon request in accordance with such regulations as may be applicable, or for a tuber propagated variety a tissue culture will be deposited in a public repository and maintained for the duration of the certificate.

The undersigned owner(s) is(are) the owner of this sexually reproduced or tuber propagated plant variety, and believe(s) that the variety is new, distinct, uniform, and stable as required in Section 42, and is entitled to protection under the provisions of Section 42 of the Plant Variety Protection Act.

Owner(s) is(are) informed that false representation herein can jeopardize protection and result in penalties.

SIGNATURE OF OWNER Dale Zetocha		SIGNATURE OF OWNER	
NAME (Please print or type) Dale Zetocha		NAME (Please print or type)	
CAPACITY OR TITLE Executive Director NDSU Research Foundation	DATE 2/5/01	CAPACITY OR TITLE	DATE

200100090

GENERAL: To be effectively filed with the Plant Variety Protection Office (PVPO), ALL of the following items must be received in the PVPO: (1) Completed application form signed by the owner; (2) completed exhibits A, B, C, E; (3) for a seed reproduced variety at least 2,500 viable untreated seeds, for a hybrid variety at least 2,500 untreated seeds of each line necessary to reproduce the variety, or for tuber reproduced varieties verification that a viable (in the sense that it will reproduce an entire plant) tissue culture will be deposited and maintained in an approved public repository; (4) check drawn on a U.S. bank for \$2,705 (\$320 filing fee and \$2,385 examination fee), payable to "Treasurer of the United States" (See Section 97.6 of the Regulations and Rules of Practice.) Partial applications will be held in the PVPO for not more than 90 days, then returned to the applicant as unfilled. Mail application and other requirements to Plant Variety Protection Office, AMS, USDA, Room 500, NAL Building, 10301 Baltimore Avenue, Beltsville, MD 20705-2351. Retain one copy for your files. All items on the face of the application are self explanatory unless noted below. Corrections on the application form and exhibits must be initialed and dated. DO NOT use masking materials to make corrections. If a certificate is allowed, you will be requested to send a check payable to "Treasurer of the United States" in the amount of \$320 for issuance of the certificate. Certificates will be issued to owner, not licensee or agent.

Plant Variety Protection Office
Telephone: (301) 504-5518
FAX: (301) 504-5291
Homepage: <http://www.ams.usda.gov/science/pvp.htm>

ITEM

- 18a. Give: (1) the genealogy, including public and commercial varieties, lines, or clones used, and the breeding method;
(2) the details of subsequent stages of selection and multiplication;
(3) evidence of uniformity and stability; and
(4) the type and frequency of variants during reproduction and multiplication and state how these variants may be identified
- 18b. Give a summary of the variety's distinctness. Clearly state how this application variety may be distinguished from all other varieties in the same crop. If the new variety is most similar to one variety or a group of related varieties:
(1) identify these varieties and state all differences objectively;
(2) attach statistical data for characters expressed numerically and demonstrate that these are clear differences; and
(3) submit, if helpful, seed and plant specimens or photographs (prints) of seed and plant comparisons which clearly indicate distinctness.
- 18c. Exhibit C forms are available from the PVPO Office for most crops; specify crop kind. Fill in Exhibit C (Objective Description of Variety) form as completely as possible to describe your variety.
- 18d. Optional additional characteristics and/or photographs. Describe any additional characteristics that cannot be accurately conveyed in Exhibit C. Use comparative varieties as is necessary to reveal more accurately the characteristics that are difficult to describe, such as plant habit, plant color, disease resistance, etc.
- 18e. Section 52(5) of the Act requires applicants to furnish a statement of the basis of the applicant's ownership. An Exhibit E form is available from the PVPO.
19. If "Yes" is specified (seed of this variety be sold by variety name only, as a class of certified seed), the applicant MAY NOT reverse this affirmative decision after the variety has been sold and so labeled, the decision published, or the certificate issued. However, if "No" has been specified, the applicant may change the choice. (See Regulations and Rules of Practice, Section 97.103).
21. See Section 83 of the Act for the Contents and Term of Plant Variety Protection.
22. See Sections 41, 42, and 43 of the Act and Section 97.5 of the regulations for eligibility requirements.
23. See Section 5.5 of the Act for instructions on claiming the benefit of an earlier filing date.

21. CONTINUED FROM FRONT (Please provide a statement as to the limitation and sequence of generations that may be certified.)

22. CONTINUED FROM FRONT (Please provide the date of first sale, disposition, transfer, or use for each country and the circumstances, if the variety (including any harvested material) or a hybrid produced from this variety has been sold, disposed of, transferred, or used in the U.S. or other countries.)

U.S.A. - Release date: June 23, 2000

23. CONTINUED FROM FRONT (Please give the country, date of filing or issuance, and assigned reference number, if the variety or any component of the variety is protected by intellectual property right (Plant Breeder's Right or Patent).)

NOTES: It is the responsibility of the applicant/owner to keep the PVPO informed of any changes of address or change of ownership or assignment or owner's representative during the life of the application/certificate. There is no charge for filing a change of address. The fee for filing a change of ownership or assignment or any modification of owner's name is specified in Section 97.175 of the regulations. (See Section 101 of the Act, and Sections 97.130, 97.131, 97.175(h) of the Regulations and Rules of Practice.)

To avoid conflict with other variety names in use, the applicant must check the variety names proposed by contacting: Seed Branch, AMS, USDA, Room 213, Building 306, Beltsville Agricultural Research Center-East, Beltsville, MD 20705. Telephone: (301) 504-8089.

According to the Paperwork Reduction Act of 1995, an agency may not conduct or sponsor, and a person is not required to respond to a collection of information unless it displays a valid OMB control number for this collection of information is (0581-0055). The time required to complete this information collection is estimated to average 1.4 hours per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information.

The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, gender, religion, age, disability, political beliefs, sexual orientation, and marital or family status. (Not all prohibited bases apply to all programs.) Persons with disabilities who require alternative means for communication of program information (Braille, large print, audiotape, etc.) should contact the USDA's TARGET Center at (202) 730-2600 (voice and TDD). To file a complaint of discrimination, write USDA, Director, Office of Civil Rights, Room 326-W, Whitten Building, 14th and Independence Avenue, SW, Washington, DC 20250-9410 or call (202) 720-5964 (voice and TDD). USDA is an equal opportunity provider and employer.

S&T-470 (2-99) designed by the Plant Variety Protection Office with WordPerfect 6.0a. Replaces STD-470 (6-98) which is obsolete.

EXHIBIT A - ORIGIN AND BREEDING HISTORY**'DRUMMOND'**

- Spring 1992
- Original cross made at North Dakota State University (NDSU) greenhouse.
 - Pedigree = ND9712//Stander/ND12200
 - ND9712 = Hazen/WPG821-22-13
 - WPG821-22-13 = Unknown pedigree. Dick Metcalfe (deceased), former Agriculture Canada barley breeder at Winnipeg, Manitoba, supplied seed of this line to North Dakota State University in 1983 because of its resistance to net blotch. In talking with the replacement to Dr. Metcalfe, I learned that Dr. Metcalfe's pedigree records were not kept when the breeding program was moved from Winnipeg to Brandon, Manitoba. Thus, no pedigree information is available on WPG821-22-13.
 - ND12200 = Bumper//Hazen/Azure
- Summer 1992
- F1 plants grown on NDSU research land.
- Winter 1992-93
- F2 spaced plants grown in off-season nursery located near Yuma, AZ.
 - F2 population number is C93-38.
 - Selection of F2 plants was based on maturity, plant height, awn type, and spike fertility.
- Summer 1993
- F3 head rows grown on NDSU research land.
 - Individual F3 families were selected. Selection of families was based on maturity, plant height, straw strength, kernel color, awn type, spike length, spike erectness, and spike density.
 - Within each family, three spikes were randomly selected from different plants. Two spikes were sent to the off-season nursery near Yuma, AZ and the third spike was stored as remnant seed in case of a crop failure at the winter nursery.
 - Experimental line designation is C92-14-3-3.
 - After selection of individual spikes, the remainder of each family was harvested.
- Winter 1993-94
- F4 head rows are grown at the off-season nursery near Yuma, AZ for seed increase.
 - Grain from harvested F3 head rows were evaluated for potential malting quality by the Department of Cereal Science (CS), NDSU. Parameters evaluated were barley grain protein, kernel assortment, kernel color, and barley diastatic power.
- Spring 1994
- Based on data from CS, selected F4 head rows are individually harvested.

- Seed from each F4 row is sown in preliminary yield trials.
- Summer 1994
- Experimental line designation – ND15477.
 - F5 preliminary yield trial is grown at two locations in ND on NDSU research land.
- Fall 1994
- Grain of “best” entries, including ND15477, is sent to the USDA-ARS Cereal Crops Research Unit, Madison, WI for malt quality evaluation. Barley and malt quality parameters evaluated include kernel plumpness and weight, barley protein, malt extract, fine-coarse malt extract difference, wort protein, β -glucan content, malt diastatic power, and α -amylase activity.
 - Selection of entries sent to Madison is based on agronomic (i.e., heading date, plant height, straw strength, grain yield, etc.) and disease data.
 - All entries sent to Madison are screened for net blotch and spot blotch resistance in the greenhouse by the Department of Plant Pathology, NDSU.
- Spring 1995
- Based on favorable agronomic and malt quality data, ND15477 is advanced to intermediate yield trials.
- Summer 1995
- F6 intermediate yield trial is grown at four locations in ND on NDSU research land.
- Fall 1995
- Grain of “best” entries, including ND15477, is sent to the USDA-ARS Cereal Crops Research Unit, Madison, WI for malt quality evaluation.
 - Selection of entries sent to Madison is based on agronomic (i.e., heading date, plant height, straw strength, grain yield, etc.) and disease data.
- Spring 1996
- Based on favorable agronomic and malt quality data, ND15477 is advanced to advanced yield trials.
- Summer 1996
- F7 advanced yield trials is grown at four locations in ND on NDSU research land.
- Fall 1996
- Grain of “best” entries, including ND15477, is sent to the USDA-ARS Cereal Crops Research Unit, Madison, WI for malt quality evaluation.
 - Selection of entries sent to Madison is based on agronomic (i.e., heading date, plant height, straw strength, grain yield, etc.) and disease data.
 - Pilot scale malting evaluation by the American Malting Barley Association, Inc. (AMBA) is conducted. The malting and brewing industry members of AMBA do pilot scale malting evaluation. Only malting quality is evaluated. Barley and malt quality parameters evaluated are similar to those evaluated by the USDA-ARS in Madison.

- Spring 1997 - Based on favorable agronomic and malt quality data, ND15477 is advanced to varietal yield trials and submitted for entry in the Mississippi Valley Barley Nursery.
- Summer 1997 - F8 varietal yield is grown at four locations in ND on NDSU research land.
-Mississippi Valley Barley Nursery is grown at about 15 locations each year in the Upper Midwest U.S.A. and southern Manitoba, Canada.
- Fall 1997 - Grain of "best" entries, including ND15477, is sent to the USDA-ARS Cereal Crops Research Unit, Madison, WI for malt quality evaluation.
- Selection of entries sent to Madison is based on agronomic (i.e., heading date, plant height, straw strength, grain yield, etc.) and disease data.
- Pilot scale malting evaluation is conducted by AMBA. Malting quality is evaluated.
- Spring 1998 - Based on favorable agronomic and malt quality data, ND15477 is advanced to varietal yield trials, North Dakota state varietal yields trials, and submitted for entry in the Mississippi Valley Barley Nursery.
- Summer 1998 - F9 varietal yield trial is grown at four locations in ND on NDSU research land.
- Mississippi Valley Barley Nursery is grown at about 15 locations each year in the Upper Midwest U.S.A. and southern Manitoba, Canada.
- ND barley varietal trial is grown at seven locations in ND on NDSU research land.
- Head row purification is grown at Casselton, ND.
- ND15477 is sown on about 700 acres in North Dakota to provide grain for AMBA plant scale evaluation.
- Fall 1998 - Plant scale malting and brewing evaluation by AMBA. Plant scale evaluation entails the following. About 30,000 bushels of ND15477 grain are malted and evaluated by one member of AMBA. Malt then is distributed to the two brewing members of AMBA for plant scale brewing and evaluation.
- Spring 1999 - Based on favorable agronomic and malt quality data, ND15477 is advanced to varietal yield trials, North Dakota state varietal yields trials, and submitted to the Mississippi Valley Barley Nursery.
- Summer 1999 - Varietal yield trial is grown at four locations in ND on NDSU research land.
- Mississippi Valley Barley Nursery is grown at about 15 locations each year in the Upper Midwest U.S.A. and southern Manitoba, Canada.
- ND barley varietal trial is grown is grown at seven locations in ND on NDSU research land.

- Seed increase of ND15477 is grown at Casselton, ND.
 - ND15477 is sown on about 600 acres in North Dakota to provide grain for AMBA plant scale evaluation.
- Fall 1999
- Grain of ND15477 is rejected by AMBA for plant scale evaluation because of excessive kernel blight incited by several *Fusarium graminearum*.
- Winter 1999-2000
- Seed increase of ND15477 is conducted near Yuma, AZ.
- Summer 2000
- ND15477 is released as a named cultivar, Drummond, the unselected progeny of a bulk of F9 head rows similar in plant height and heading date on 23 June 2000.
 - Varietal yield trial is grown at four locations in ND on NDSU research land.
 - Mississippi Valley Barley Nursery is grown at about 15 locations each year in the Upper Midwest U.S.A. and southern Manitoba, Canada.
 - ND barley varietal trial is grown at seven locations in ND on NDSU research land.
 - Seed increase of Drummond is conducted at Casselton and Minot, ND.
 - Drummond is sown on about 2,600 acres in North Dakota to provide grain for AMBA plant scale evaluation.
- Fall 2000
- Grain of Drummond is accepted by AMBA for second year of plant scale evaluation.
- Winter 2000-2001
- Plant scale malting and brewing evaluations are being conducted by AMBA. Status as a "barley recommended for malting and brewing" by AMBA could be decided by late summer 2001.

Drummond was observed for three generations from 1998 to 2000, and was observed to be uniform and stable within commercially acceptable limits for all traits as described in Exhibit C. Drummond has been rogued in all generations subsequent to the purification in 1998. Variants (i.e., slightly taller two-rowed barley plants) occur at a frequency of less than 1/20,000.

The pedigree breeding method was used to develop Drummond. In the early generations (i.e. F2-F4), highly heritable traits such as maturity, plant height, straw strength, kernel color, awn type, spike length, spike erectness, and spike density were selected. Starting at the F5 generation, selection criteria also included agronomic (i.e., heading date, plant height, straw strength, grain yield, etc.), disease, and malt quality (i.e. protein, malt extract, wort protein, kernel plumpness, and enzyme activity) data. Based on data from multiple locations and years, Drummond was selected for its high yield, strong straw, and favorable malt quality.

EXHIBIT B - NOVELTY STATEMENT

To my knowledge, Drummond most nearly resembles Hazen, Excel, and Foster barley. DNA analysis using polymerase chain reaction (PCR) techniques (Williams et al., 1990) with simple sequence repeat (SSR) markers (Liu et al., 1996) can easily differentiate Drummond from Hazen, Excel, and Foster. Using Scottish Crop Research Institute (Dundee, Scotland) primer pair Bmag0125, a 134 base pair (bp) band can be found in Drummond that is not present in Hazen, Excel, or Foster. A slightly smaller band can be found in Hazen, Excel, and Foster that is not found in Drummond.

Figure 1 presents a scan of a photo showing the "critical" 134 bp band. The original photo that was scanned is available upon request. In Figure 1, triplicate lanes of Hazen, Foster, Excel, and Drummond that contain bands of varying sizes can be seen. The lane markers on the outside and center of the photo can be used to determine the size of the critical band found exclusively in Drummond.

Methods

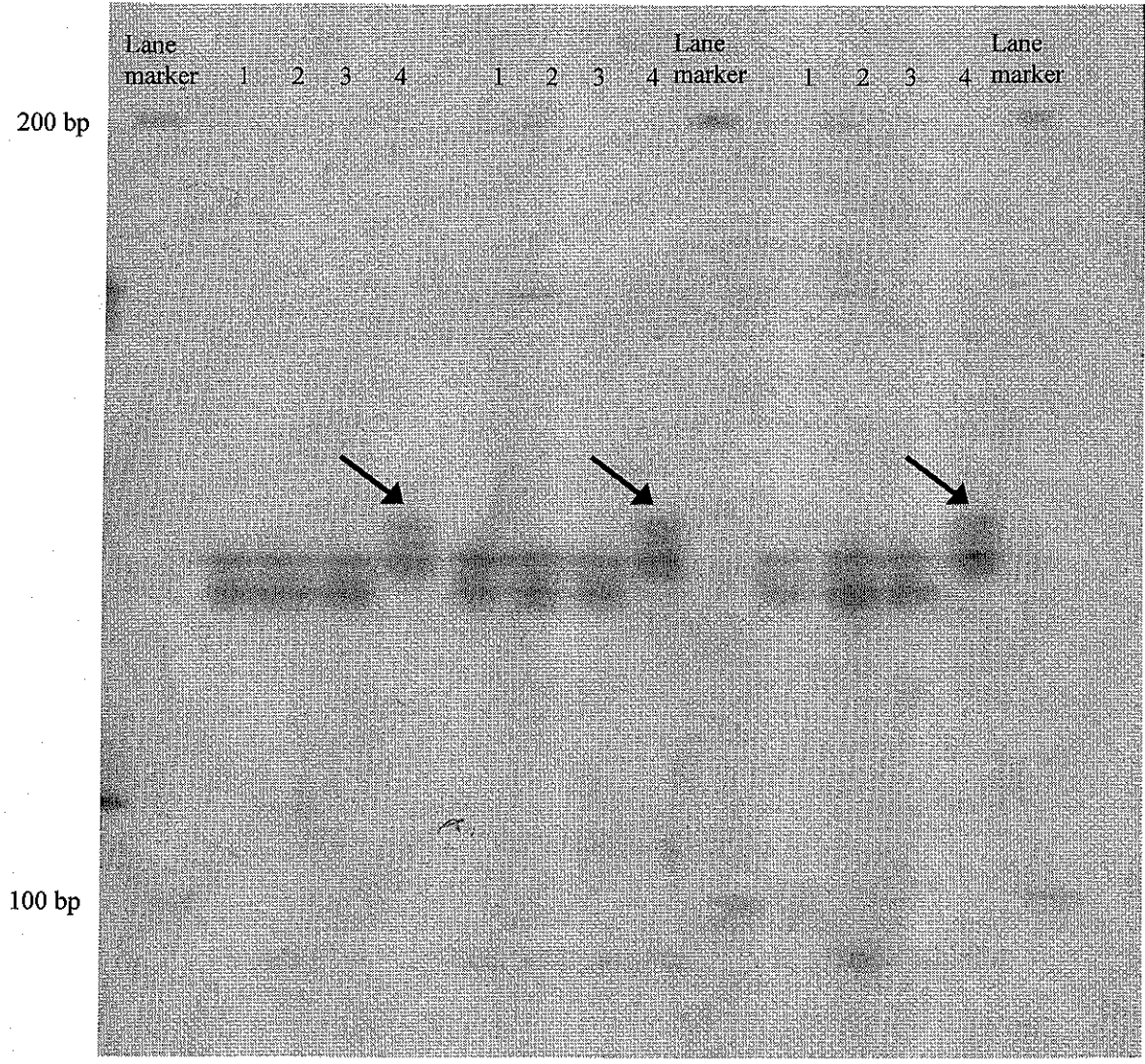
Leaf tissue was collected from Hazen, Excel, Foster, and Drummond barley and stored at -80 °C. DNA was extracted from the leaf tissue using the method of Kleinhofs (personnel communication, 1998). The four cultivars were screened for SSR polymorphisms using the method of Ramsay et al. (2000). Reaction conditions were as follows: 2.5 mM MgCl₂; 200 µM of each dATP, dCTP, dGTP, and dTTP; 5 ng of primer; 50 ng of genomic DNA; and 1.5 units Taq DNA polymerase (Promega; Madison, WI), and 1x of Taq buffer. The reaction volume was 20.0 µL. Amplification reactions were done with a Perkin-Elmer DNA thermocycler using a protocol that consists of: 1 cycle of 3 min @ 94 °C, 1 min @ 55 °C, 1 min @ 72; 30 cycles of 1 min @ 94 °C, 1 min @ 55 °C, 1 min @ 72 °C; and 1 cycle of 5 min @ 72 °C for extension. Reactions were held at 4 °C until separated in a denaturing polyacrylamide gel by electrophoresis. Bands were visualized by staining with the Promega Silver Sequence™ DNA Sequencing System (Promega; Madison, WI). Photographs of the stained gel were taken for a permanent record.

Literature Cited

- Doyle, J.J., and J.L. Doyle. 1987. A rapid DNA isolation procedure for small quantities of fresh leaf tissue. *Phytochemistry Bulletin* 19:11-15.
- Liu, Z.-W, R.M. Biyashev, M.A. Saghai Maroof. 1996. Development of simple sequence repeat DNA markers and their integration into a barley linkage map. *TAG* 93:869-876.
- Ramsay, L., M. Macaulay, S. degli Ivanissevich, K. MacLean, L. Cardle, J. Fuller, K. J. Edwards, S. Tuveeson, M. Morgante, A. Massari, E. Maestri, N. Marmiroli, T. Sjakste, M. Ganai, W. Powell, and R. Waugh. 2000. A simple sequence repeat-based linkage map of barley. *Genetics* 156:1997-2005.

Williams, J.G.K., A.R. Kubelik, K.J. Livak, J.A. Rafalski, and S.V. Tingey. 1990. DNA polymorphisms amplified by arbitrary primers are useful as genetic markers. *Nucleic Acids Res.* 18:6531-6535.

Figure 1. Denaturing polyacrylamide gel showing a 134 base pair (bp) simple sequence repeat (SSR) polymorphism, using Scottish Crop Research Institute primer pair Bmag0125, that distinguishes Drummond barley from Hazen, Foster, and Excel barley. Lane code is: 1=Hazen, 2=Foster, 3=Excel, and 4=Drummond.



U.S. DEPARTMENT OF AGRICULTURE
AGRICULTURAL MARKETING SERVICE
REGION
BELTSVILLE, MARYLAND 20705

EXHIBIT C
(Barley)

OBJECTIVE DESCRIPTION OF VARIETY
BARLEY (*HORDEUM VULGARE*)

INSTRUCTIONS: See Reverse.

NAME OF APPLICANT(S)

NDSU Research Foundation

ADDRESS (Street and No. or R.F.D. No., City, State, and ZIP Code)

P.O. Box 5014

Fargo, ND 58105-5014

FOR OFFICIAL USE ONLY

PVPO NUMBER

200100090

VARIETY NAME OR TEMPORARY
DESIGNATION

Place the appropriate number that describes the varietal character of this variety in the boxes below.
Place a zero in first box (i.e. or) when number is either 99 or less or 9 or less.

1. GROWTH HABIT:

1 - SPRING 2 - FACULTATIVE WINTER 3 - WINTER Early Growth: 1 - PROSTRATE 2 - SEMIPROSTRATE
3 - ERECT

2. MATURITY (50% Flowering):

1 - EARLY (California Mariout) 2 - MIDSEASON (Betzes) 3 - LATE (Frontier)

No. of days Earlier than } 1 - BETZES 2 - CALIFORNIA MARIOUT 3 - CONQUEST 4 - DICKSON
 No. of days Later than } 5 - PIROLINE 6 - PRIMUS 7 - UNITAN

3. PLANT HEIGHT (From soil level to top of head):

1 - SEMIDWARF 2 - SHORT (California Mariout) 3 - MEDIUM TALL (Betzes) 4 - TALL (Conquest)

Cm. Shorter than } 1 - BETZES 2 - CALIFORNIA MARIOUT 3 - CONQUEST 4 - DICKSON
 Cm. Taller than } 5 - PIROLINE 6 - PRIMUS 7 - UNITAN

4. STEM:

Exertion (Flag to spike at maturity): 1 - 0 - 3 cm. 2 - 3 - 10 cm. Anthocyanin: 1 - ABSENT 2 - PRESENT
3 - 10 - 15 cm.

NO. OF NODES (Originating from node above ground)

Collar Shape: 1 - CLOSED 2 - V-SHAPED 3 - OPEN Shape of Neck: 1 - STRAIGHT 2 - SNAKY
4 - MODIFIED CLOSED OR OPEN 3 - OTHER (Specify)

5. LEAF:

Basal leaf sheath (seedling): 1 - GLABROUS 2 - PUBESCENT Position of flag leaf (at boot stage): 1 - DROOPING
2 - UPRIGHT

Waxiness: 1 - ABSENT (Glossy) 2 - SLIGHTLY WAXY MM. WIDTH (First leaf below flag leaf)
3 - WAXY

CM. LENGTH (First leaf below flag leaf) Anthocyanin in leaf sheath: 1 - ABSENT 2 - PRESENT

6. HEAD:

Type: 1 - TWO-ROWED 2 - SIX-ROWED Density: 1 - LAX 2 - ERECT (Not dense)
3 - ERECT (Dense)

Shape: 1 - TAPERING 2 - STRAP 3 - CLAVATE Waxiness: 1 - ABSENT (Glossy) 2 - SLIGHTLY WAXY
4 - OTHER (Specify) 3 - WAXY

Lateral Kernels Overlap: 1 - NONE 2 - AT TIP Rachis (Hair on edge): 1 - LACKING 2 - FEW 3 - COVERED
3 - 1/4 - 1/2 OF HEAD

7. GLUME:

Length: 1 - 1/3 OF LEMMA 2 - 1/2 OF LEMMA Hairs: 1 - NONE 2 - SHORT 3 - LONG
3 - MORE THAN 1/2 OF LEMMA

Hair covering: 1 - NONE 2 - RESTRICTED TO MIDDLE 3 - CONFINED TO BAND 4 - COMPLETELY COVERED

Awns: 1 - LESS THAN EQUAL TO LENGTH OF GLUMES 2 - EQUAL TO LENGTH OF GLUMES
3 - MORE THAN EQUAL TO LENGTH OF GLUMES

Awn Surface: 1 - SMOOTH 2 - SEMISMOOTH 3 - ROUGH

8. LEMMA:

- ☐ 5 Awn: 1 = AWNLESS 2 = AWNLETS ON CENTRAL ROWS AWNLESS ON LATERAL ROWS
3 = SHORT ON CENTRAL ROWS, AWNLETS ON LATERAL ROWS 4 = SHORT (less than equal to length of spike)
5 = LONG (longer than spike) 6 = HOODED
- ☐ 3 Awn Surface: 1 = AWNLESS 2 = SMOOTH 3 = SEMISMOOTH 4 = ROUGH
- ☐ 3 Teeth: 1 = ABSENT 2 = FEW 3 = NUMEROUS ☐ 1 Hair: 1 = ABSENT 2 = PRESENT
- ☐ 3 Shape of base: 1 = DEPRESSION 2 = SLIGHT CREASE 3 = TRANSVERSE CREASE ☐ 2 Rachilla Hairs: 1 = SHORT 2 = LONG

9. STIGMA:

- ☐ 1 Hairs: 1 = FEW 2 = MANY

10. SEED:

- ☐ 2 Type: 1 = NAKED 2 = COVERED ☐ 1 Hairs on Ventral Furrow: 1 = ABSENT 2 = PRESENT
- ☒ 8 Length: 1 = SHORT (8.0 mm.) 2 = SHORT TO MIDLONG (7.5 - 9.0 mm.) 3 = MIDLONG (8.5 - 9.5 mm.)
4 = MIDLONG TO LONG (9.0 - 10.5 mm.) 5 = LONG (10.0 mm.)
- ☐ 2 Wrinkling of hull: 1 = NAKED 2 = SLIGHTLY WRINKLED 3 = SEMIWRINKLED 4 = WRINKLED
- ☐ 1 Aleurone Color: 1 = COLORLESS (White or Yellow) 2 = BLUE
- ☐ 0 ☐ 5 PERCENT ABORTIVE ☐ 3 ☐ 3 GMS. PER 1000 SEEDS

11. DISEASE: (0 = Not Tested, 1 = Susceptible, 2 = Resistant)

- ☐ 1 SEPTORIA ☐ 1 NET BLOTCH ☐ 2 SPOT BLOTCH ☐ 1 POWDERY MILDEW
- ☐ 1 LOOSE SMUT ☐ 2 BACTERIAL BLIGHT ☐ 1 COVERED SMUT ☐ 1 FALSE LOOSE SMUT
- ☐ 1 STEM RUST ☐ 1 LEAF RUST ☐ 1 SCAB ☐ 1 SCALD
- ☐ 0 AY ☐ 2 BSMV ☐ 1 BYDV ☐ OTHER (Specify)

12. INSECT: (0 = Not tested, 1 = Susceptible, 2 = Resistant)

- ☐ 0 GREEN BUG ☐ 0 ENGLISH GRAIN APHID ☐ 0 CHINCH BUG ☐ 0 ARMYWORM
- ☐ 0 GRASS HOPPERS ☐ 0 CERIAL LEAF BETTLE ☐ 0 OTHER (Specify)
- HESSIAN FLY RACES ☐ 0 GP ☐ 0 A ☐ 0 B ☐ 0 C
☐ 0 D ☐ 0 E ☐ 0 F ☐ 0 G

13. CHEMICAL (0 = Not Tested, 1 = Susceptible, 2 = Resistant)

- ☐ 0 DDT ☐ OTHER (Specify)

14. INDICATE WHICH VARIETY MOST CLOSELY RESEMBLES THAT SUBMITTED:

CHARACTER	NAME OF VARIETY	CHARACTER	NAME OF VARIETY
Plant tillering	Foster	Seed size	Foster
Leaf size	Foster	Coleoptile elongation	Foster
Leaf color	Foster	Seedling pigmentation	Foster
Leaf carriage	Foster		

REFERENCES: The following publications may be used as a reference aid for the standardization of character descriptions and terms used in this form:

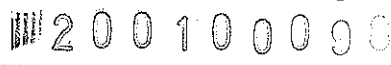
1. Wiebe, G. A., and D. A. Reid, 1961, Classification of Barley Varieties Grown in the United States and Canada in 1958, Technical Bulletin No. 1224, U.S. Dept. of Agriculture.
2. Reid, D. A., and G. A. Wiebe, 1968, Barley: Origin, Botany, Culture, Winter Hardiness, Genetics, Utilization, Pests, Agriculture Handbook No. 338, U.S. Dept. of Agriculture. pp. 61 - 84.
3. Malting Barley Improvement Association, Milwaukee, Wisconsin, 1971, Barley Variety Dictionary.

COLOR: Nickerson's or any recognized color fan may be used to determine color of the described variety.

U.S. DEPARTMENT OF AGRICULTURE
AGRICULTURAL MARKETING SERVICE**EXHIBIT E**
STATEMENT OF THE BASIS OF OWNERSHIP

The following statements are made in accordance with the Privacy Act of 1974 (5 U.S.C. 552a) and the Paperwork Reduction Act (PRA) of 1995.

Application is required in order to determine if a plant variety protection certificate is to be issued (7 U.S.C. 2421). Information is held confidential until certificate is issued (7 U.S.C. 2426).

1. NAME OF APPLICANT(S) NDSU Research Foundation	2. TEMPORARY DESIGNATION OR EXPERIMENTAL NUMBER ND15477	3. VARIETY NAME 'Drummond'
4. ADDRESS (Street and No., or R.F.D. No., City, State, and ZIP, and Country) c/o Executive Director P.O. Box 5014 Fargo, ND 58105-5014	5. TELEPHONE (include area code) (701) 231-8931	6. FAX (include area code) (701) 231-1013
7. PVPO NUMBER 		
8. Does the applicant own all rights to the variety? Mark an "X" in appropriate block. If no, please explain. <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO		

9. Is the applicant (individual or company) a U.S. national or U.S. based company? If no, give name of country <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO	
10. Is the applicant the original owner? <input type="checkbox"/> YES <input checked="" type="checkbox"/> NO If no, please answer <u>one</u> of the following: a. If original rights to variety were owned by individual(s), is (are) the original owner(s) a U.S. national(s)? <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO If no, give name of country b. If original rights to variety were owned by a company(ies), is(are) the original owner(s) a U.S. based company? <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO If no, give name of country 11. Additional explanation on ownership (if needed, use reverse for extra space):	

PLEASE NOTE:

Plant variety protection can be afforded only to owners (not licensees) who meet one of the following criteria:

1. If the rights to the variety are owned by the original breeder, that person must be a U.S. national, national of a UPOV member country, or national of a country which affords similar protection to nationals of the U.S. for the same genus and species.
2. If the rights to the variety are owned by the company which employed the original breeder(s), the company must be U.S. based, owned by nationals of a UPOV member country, or owned by nationals of a country which affords similar protection to nationals of the U.S. for the same genus and species.
3. If the applicant is an owner who is not the original owner, both the original owner and the applicant must meet one of the above criteria.

The original breeder/owner may be the individual or company who directed final breeding. See Section 41(a)(2) of the Plant Variety Protection Act for definition.

According to the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number. The valid OMB control number for this information collection is 0581-0055. The time required to complete this information collection is estimated to average 10 minutes per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information.

The U.S. Department of Agriculture (USDA) prohibits discrimination in its programs on the basis of race, color, national origin, sex, religion, age, disability, political beliefs, and marital or familial status. (Not all prohibited bases apply to all programs). Persons with disabilities who require alternative means for communication of program information (braille, large print, audiotape, etc.) should contact USDA's TARGET Center at 202-720-2600 (voice and TDD).

To file a complaint, write the Secretary of Agriculture, U.S. Department of Agriculture, Washington, D.C. 20250, or call 1-800-245-6340 (voice) or (202) 720-1127 (TDD). USDA is an equal employment opportunity employer.

STD-470-E (07-97) (Destroy previous editions).

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EXHIBIT E - STATEMENT OF THE BASIS OF THE APPLICANT'S OWNERSHIP

Dr. Richard Horsley, an employee of the North Dakota Agricultural Experiment Station and North Dakota State University, is a plant breeder who developed 'DRUMMOND', the six-rowed spring barley cultivar for which Plant Variety Protection is hereby sought. The employee by agreement and because of the condition of the use of the facilities and funds of the North Dakota Agricultural Experiment Station and North Dakota State University has assigned all ownership rights to 'DRUMMOND' barley to the North Dakota Agricultural Experiment Station and North Dakota State University.

North Dakota State University on behalf of the North Dakota Agricultural Experiment Station has assigned all ownership to the NDSU Research Foundation. The NDSU Research Foundation is a nonprofit corporation set up to own and manage the intellectual property of North Dakota State University.